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THE RELATION OF BOTANY TO AGRICULTURE[1]

THE relation of botany to agriculture is an interesting subject to discuss, whether stated in this form or as the relation of agriculture to botany. It is capable of being stated in a dozen other forms, equally suggestive. In every one of its aspects it has been discussed and rediscussed until little remains except to piece together selected fragments of excellent thought into the skeleton of a new picture, somewhat as a composite is made of the photographs of hundreds of men and women in a picture that sometimes is thought to present the character of the whole though no one of its components may be recognizable in it,—or one may dominate all the rest.

Without agriculture, there would be no botany. Without botany, agriculture would be little more than empiricism; but this empiricism would contain in itself the seeds of evolutionary improvement, out of which botany must inevitably grow. The interrelation is a little like that of nutrition and sensation in an animal, and you can trace a large number of parallels between the two cases if you wish.

If, when and as (to quote the stock promoters) the human world becomes stabilized in its mastery of itself and its environment, it may standardize and codify all that it knows and does into a uniformity of action and corresponding expression that will make the choice of words easier than it is now. An imaginative Chinese student of agriculture a few years ago pictured an approach to this condition—in one direction—by considering the waste areas of the earth's waters to be covered by floating gardens from continent to continent between favorable isotherms; much as an imaginative engineer might picture the roofs of our houses converted into a continuous highway for terrestrial use marked here and there by landing stages for aerial birds of passage.

At present we not only use different words to convey essentially identical ideas and the same word to convey ideas that are not the same, but we have a confusing habit of defining our expressions differently or, through mental reservations, of talking about something else when we have accepted a nominal definition of a word.

To some people, the word botany is broad enough to comprise anything whatever directly concerning plants: their structure, their function, their interrelations with one another and with environing nature, their structures or stores that we appropriate to our

[1] Sigma Xi address at Iowa State College, May 3, 1924.

own uses, their response to a little protection in reseeding our vanishing forests, their pliability under the hands of the cultivator and the breeder, in fact, anything in which the name plant or any of its synonyms or subdivisions figures.

Not long since, an educator, who is not a biologist but one sympathetic with science, criticized a general college course in botany as too comprehensive because it touched on such topics as the ecology, physiology and pathology of plants. Possibly he would have defined botany in the time-honored sense of a century ago when to be a botanist one must "know plants" and when, as Professor Torrey once expressed it, one who did not "know" four hundred plants was hardly qualified as a professor of botany.

The one-time dean of a great college of agriculture, who at the same time was a botanist who knew his four hundred plants, among other things used to begin his lectures on general botany by stating that botany is the science that concerns itself with plants, that science is organized knowledge and that plants are—well, what are plants anyway?—let us say, living things that are not animals.

A Spanish author accounts for the bull-fighting instincts of his race by carrying these back to the time when that race was a race of hunters and of tamers and then breeders of animals, and that passed to the regulated procedure of the arena by way of the less democratic inquisition.

If, as some people would deny, our remote ancestors were tree-dwellers, they must have been vegetarians to a large extent. Even after that great epoch of progress that the teachers of evolution delight in picturing, when they learned to hold their own on the ground and to defend themselves against the brutes that had claws and fangs and horns, they must have eaten fruits and succulent stems and leaves and starchy roots in larger quantity than flesh. A Darwinian would say that even our teeth show this. How many generations it must have required to pick out and reject the harmful of these reservoirs of nourishment and latent solar energy. How many generations more it must have required to transform some of their crude weapons into even cruder tools and to have acquired the art of transplanting and protecting the best of these!

That, and the domestication of animals, constitute the dawn of agriculture. Before the day of the Jews, and that was five thousand years ago, the art was crudely practiced. Its practice contained in itself the rudiments of biology—this much can be seen in the Scriptures and in echoes of the earliest civilizations. By the time of the Greeks, with their analytical minds and their didactic habits, very much seems to have been known or thought here and there about plants.

Very likely it was Aristotle who winnowed and selected and shaped up this knowledge and tradition, this plant-lore, into a rational whole: but it was his friend and pupil Theophrastus who first put it into permanent written form. As a science, an organized assemblage of the knowledge of plants, botany thus came into existence several hundred years before the Christian era began.

When the idealistic Greek was being supplanted by the more practically minded Roman, agriculture came into its own. Science seems not to have been much talked of, but the pleasures and profits of country life appealed to writers—and to readers without whom there would have been little call for writers. Students of the joint evolution of botany and agronomy and horticulture, find an interesting contrast between the Inquiry into Plants of Theophrastus, three centuries before the birth of Christ, and the Natural History of Pliny near the end of the first century of the Christian era. The one is the orderly organization of a science, containing germs of applicable knowledge rather than prescriptions for its application. The other, with the chaff less carefully winnowed from the grain, is an encyclopedic compendium of what was known or believed.

History is said to repeat itself. The curious thinker possibly may find that, to-day, readers prefer the practical conclusions at end of a learned dissertation to painstakingly mastering the details on which these conclusions are based. Every teacher has noticed that students are keener for the sweets and the nuts in a course than for the meat that must be chewed. I must confess that I myself prefer Bailey's Cyclopedia to the great Floras—for many purposes.

If we follow my friend the dean in considering botany to be the science that deals with plants, we shall have to go a bit further along the same road and consider that—if animals are living things that are not plants—zoology is the science that concerns itself with animals.

Whether or no we frankly consider ourselves as being animals, we have to face the fact that our own natural history and morphology and anatomy and physiology and pathology stand out in particular emphasis in one's mind when these words are mentioned, so that it is not very surprising that separate sciences —first anatomical and physiological, then pathological —should have broken free within the general science of zoology. At first human, then comparative, these offshoots have hung for a time loosely to the parent science, then have separated and drifted away from it like jellyfish from a medusa.

To-day, like chemistry and physics, a knowledge of the general laws of these segregates is presupposed for intelligent study of the generalized and comprehensive science of which they were a part originally

and in which they still enter in its broad and synthetic understanding.

I never have heard it said how many animals one should "know" if he is to qualify as a professor of zoology; but as there are several times as many kinds of animals as there are of plants, it probably would not fall far short of two thousand on the basis adopted for a botanist. The major part of these kinds of animals probably fall among the insects, those wonderful little creatures that sometimes surpass us in social subordination of the individual, in industry and in thrift, and that at times rise to a superhexapoecian if not almost a human intelligence.

Zoologists now and then fall back on selected types of insects like potato beetles or fruit flies for analysis of some of the fundamental problems of variation and heredity, of mutation and evolution; but entomology usually stands apart from zoology, now-a-days, as a separate science—possibly because the novice finds it easier to become acquainted with a thousand individual bepestered bees or hungry grasshoppers or thirsty mosquitoes than with a tithe of that number of kinds of insects.

Botany, likewise, has disintegrated as a whole. Its roots are widespread and its branches cover as much ground, but its proliferation has been somewhat different from that of zoology. Like a Canada thistle it has sent its offsets up in competition with each other and with the parent stock. They are tenacious of the ground that they hold and are not easily eradicable, but they have not that enviable independence of environment that the anatomy and physiology of animals have enjoyed through their relation to the human frame and to life.

In a way comparable with entomology, bacteriology has broken away from the parent stock, with directly economic aims; a modicum of demonstrable structure to work from, but a world of intricate physiological problems to be solved—developing, even, a physiological basis of classification quite its own and not found successfully applicable elsewhere in biology. Debatably plants or animals, these smallest and least structurally specialized of living things, the bacteria, may well be left as the most tenable of protista, in the hope that for them a science may be evolved finally comparable with botany and zoology.

Some years ago the dean of a college of agriculture asked my opinion as to whether—since time could not be spared for both—an elementary course in botany or such a course in zoology should be required in his college, or whether one or the other should be required according to agricultural specialization along the different lines of plant industry or animal industry. It was and remains a hard question to answer.

A few years ago if the question had been asked publicly the answer would have been shouted "Neither: a course in general science!" Half a century ago, when too exclusively descriptive zoology and botany were being revivified by Huxley and his South Kensington associates, the answer would have been "Neither: a course in biology!" Both would have been right: but—I do not say that this is my own opinion—it is claimed often enough to receive attention that a department of biology has the advantage of calling for one professor instead of two, and that one does not need to be a professor, even to teach general science. Possibly, of course, any such opinions rest on a disbelief that a professor of zoology could be found "knowing" his 2,400 kinds of plants and animals—or that an expounder of general science really could be expected to have personal acquaintance with a score in both fields, to say nothing of the constellations and the chemical elements and so on.

My answer to the question asked me, given for what it was worth, was to the effect that—judging from a money standard only—plant industry is twice as important as animal industry, in agriculture, that both depend upon the functioning of living things, that this physiological functioning is closely dependent upon structure differentiation, that structure and function in the main are simpler in plants than in animals; well, perhaps the drift of the argument was that the essential general principles of coordinated structure and function could be taught more simply through botany, and at any rate that green plants are the food-makers for the whole world, so that successful animal life never can be divorced from productive plant life, and that even the stock man, in the main, must have an agronomist's understanding of plant life thoroughly as a foundation for his own specialization.

For very many years I had been out of close connection with botany as taught in agricultural colleges as contrasted with botany as taught elsewhere. During these years it had been my business and my pleasure to keep a pretty close watch on the growth and trend of botanical literature, and now and then I had scanned with interest some new text on agricultural botany or on botany for students of agriculture.

Then I was invited to head the department of botany in one of our great state universities which included an unusually strong college of agriculture. Before replying to the invitation I made a pilgrimage to my old campus, Cornell, to ask of an authority—the dean of the college of agriculture at Ithaca—what botany was needed for such a college that was not needed elsewhere; because that college at Cornell had been absorbing most of the botany of the entire university.

The answer was short and simple, and the argu-

ment supporting it was direct, as any one who knows L. H. Bailey will understand, "Botany for agriculture need not be different from botany for anything else; it ought to be botany; good morphology—more of the kind that Asa Gray used to teach, good physiology, and personal acquaintance with plants."

That *is* botany, after all, isn't it, and can agriculture dispense with botany?

There are two very different ways of looking at questions: the—disinterested, I might say—way of viewing them quite impartially from the outside, and the—perhaps selfish—way of seeing how they may be answered most profitably to us.

Mitchell recently has analyzed our national life and habits and rather unflatteringly tells us that though we have learned a good many things we have not learned how to live.

This process of not learning begins when as very little children we ask questions that our elders—Barrie would say our betters—can not answer. Every one who has seen the racing speed with which the years convert a questioning child into a "don't-know" grown-up has had a chance to see what brings about the change.

School and college are too busy with other, perhaps more obvious, matters to bother with correcting this little detail. This may suggest what I mean when I speak of the different viewpoints on any question taken from the outside and the inside. Until critical—perhaps too often destructively critical—analyses, like that of Mitchell, shall have come home to us in betterments of what we proudly call the finest educational system in the world, we certainly shall not have learned to live—as Mr. Eliot has expressed it, to get the joy out of life.

We are traveling very rapidly now along the road of vocational training, a road that is making of us successful specialists in the great fundamental industries of agriculture, manufacture, engineering and commerce, as well as in what sometimes are spoken of as the learned professions—or the professions, for short. Material national prosperity lies along this road, but if we are to conquer what Mitchell takes to be our national malady we can not wear blinders as we travel it; we must see and enjoy the delights of living as we perform the work that for most of us, happily, gives the means of living.

So the relations of botany to agriculture, as I see them, go far beyond the class-room where botany is taught as a foundation or as a part of agriculture. They begin with the child's interest in everything about it, they touch the reservation of a bit of the home surroundings for a flower-garden pure and simple, they put more than a money value on the woods pasture and the bog meadow, they preserve in natural parks for coming generations some of our heritage of nature which should be inalienable.

I have read many essays on botany, past, present and to-be. I have noted with concern that it is less taught even than formerly in our secondary schools. I have found, more than once, after recommending a teacher of botany to a superintendent, that he has had to get some one who also could direct athletics. I have shared the lament of a distinguished botanist, converted into an eminent agronomist, that botany, however suitable it may be, is not aggressively coming into its own as fundamental to the art out of which it has grown and which as it has grown it has lifted to undreamed-of successes. These and many more of its failures are matters of every-day observation.

Botany, more even than zoology, has suffered through the segregation of its application. When Mr. Wilson was secretary of agriculture, a skilful organization brought together under him the federal branches dealing with agricultural botany—all but forestry which stood and still stands apart from the Bureau of Plant Industry: the significance of ecology was not then so evident as now.

It is not so very many years since in an agricultural college one man served as professor of botany, of horticulture and of forestry, though agronomy as a part of plain agriculture even then stood by itself. To-day, if more than one of these subjects be found in a department it is usually for reasons of administrative correlation rather than because of their consanguinity.

Like agronomy, these specialties all rest on a knowledge of the structure and the work and the environmental relations of plants, all of which conform to laws that form a part of the science of botany and that, under whatever name, have been framed by botanists.

One might almost venture the assertion that whether called a clerical, like Mendel, a farmer, like Lawes, a horticulturist, like Burbank, or an unclassified naturalist, like Darwin, all those men who have made great economic plant-industry advances have been in reality botanists.

If I were to sum up in general terms the relations of botany to agriculture in college, I should say that, whether called genetics or agronomy, every fundamental step in plant breeding is botany; whether called floriculture or olericulture, every recognition of mutation and every selection based upon it is botany; whether called fighting weeds, in agronomy, or reseeding the wood-lot, in forestry, every ecologically grounded procedure is botany; whether you practice prophylaxis or quarantine or bring into existence resistant races, every step in combating plant

disease is directly applied botany; and even the season for most satisfactory pruning, the selection of full-weight seeds and the proper utilization of those that are under-ripened, all rest on botanical discovery brought about—under whatever name you like—by botanical investigation.

The day may come possibly when we shall place all such botanical studies in the hands of doctors of agronomy or doctors of olericulture or doctors of pomology; but learned as the agronomists and olericulturists and pomologists and other specialists are who are adding untold wealth to the country every year through their specially trained and concentrated skill, it appears that to-day for the most part these men actually are doctors who have taken their major work in botany, and minor work only in the paramount field within which they planned to apply their training in this fundamental science, The relation is somewhat that between discovery and invention—with larger financial rewards on the applied side.

So, as to college botany in relation to agriculture, I come back to Bailey's opinion that agriculture needs and ought to have instruction in the essentials of botany—good morphology, good physiology, to-day good ecology, and personal acquaintance with plants.

A real morphologist, with a free hand, can teach the morphology that is needed. Unfortunately, a free hand means free time: he may find that, possibly; but, and this is crucial, his students do not.

A modern physiologist seems to find a modern laboratory necessary if he is to teach the necessary physiology. Quantitative exactness is so much a part of a subject so largely physico-chemical, that we do not appear to pause long enough to realize that its high points were worked out qualitatively and organized into unity without such appliances; but time fails the student even if the teacher see the broader and more generalized side of his needs, or can meet the more specialized requirements.

The hardest part of the prescription to fill, though, is supplying a personal acquaintance with plants: and this should be the easiest. Most agriculturists who talk to me about the shortcomings of students find that they do not "know" plants.

Colleges, and particularly agricultural colleges, suffer tremendously now-a-days from being urban or suburban institutions. They suffer correspondingly from being gigantic institutions. Even with gardens, if we have them, though we may carry reduced advanced classes along, specimen in hand, we can not do this adequately for the beginners who need it most; and few of us have even such gardens as, for example, the old-fashioned course in medical botany has given to so many European universities.

My idea is that the botany needed in agriculture must begin before college and specialization are reached—let us say, for the moment, in the high school. That simplifies it very much—or would simplify it if Bailey's simple prescription could be filled in the high school. Fifty years ago that might have been looked for. Botany did not comprise much more than the elements of descriptive morphology and a personal acquaintance with common (we called them familiar) wild and garden flowers.

This acquaintance is not given now in most high schools because the teacher has missed it. The prospective high school teacher of botany finds now that he or she must be prepared to teach history or mathematics or something else, as well. The bars are being raised steadily, and on excellent argument, for a prerequisite in education that in some states surpasses the major requirements in a balanced college curriculum.

Certainly the educated college student can not be allowed to go out without a general high-points knowledge of the working of the world's food-makers-plants; of the wonders of even their complex mechanism; of the nucleus of each and every cell, which means so much for its formation and functioning; of its chromosomes—the mechanical basis of heredity. But where is the background?

A reaction that it appears very easy to get with a large beginning class in botany illustrates one of the difficulties in the way of making progress in any line of botany. Did you ever sketch the current belief in some phenomenon or other as merely the working hypothesis of the moment, picture its ultimate establishment or replacement through investigation under exact control of conditions and an isolation of factors such as Mendel or DeVries would have ensured and say casually, "Some one of you may give an answer to this question"? The heehaw with which a class looks around for the goat—outward and rarely inward—would be very amusing if it were not so very pitiful.

It takes a long time for the idea of producing to enter into most of us, who are born and educated as consumers: yet somewhere among these beginners is found the material out of which investigators are shaped up when maturity has brought the idea that the opportunity of life really is an opportunity of balanced give and take. After a century and more it is as hard to make the beginner realize that we are merely on the threshold of knowing and understanding nature as it was when Linnaeus, the great systematizer of biological science, showed an unknown moss under his hand, placed at random on the ground, to a student who was expressing his sympathy with the master who knew all nature and

yet spent so much of his time in teaching to others what he knew perfectly.

Here is the kernel of what I am trying to say. Nature-knowledge, whatever you call it, must be brought back into the home—and this ought to be through the kindergarten and the primary school. Teachers in these schools ought to be helped in high school to "know" the plants and the birds and the common insects and other denizens of field and forest.

A high school teacher of biology—under any name—who can not help the forming grade teachers to get this knowledge really is not fitted for the place he holds: but college too rarely can or does fit him. Until what we call our educational system is reformed through evolution or revolution, I fear that we must look for the beginnings of this knowledge where they lay several generations ago—among the self-helped and self-taught fathers and mothers to whom little children turn—at first—in the confidence that they know or have or will learn or will get what is asked for whenever it is neither unreasonable nor harmful. My heart is very warm for the person groping for such self-help: and for the simple-minded apostle of a real nature-knowledge, who in the complexity of our specializations and prerequisite requirements can not reasonably hope to get or hold a teacher's place, whatever he may know, unless he produce some sort of academic sealed and be-ribboned open-sesame.

If ever we can get back to this common possession of our modestly educated forefathers—and the means of self-education are myriad now where they were few for our ancestors—no college class will smile at the thought that it may contain a potential Hales, or Hofmeister, a Gray, or Mendel. Self-evidently it will contain the fundamental of inherent acquaintanceship with the great makers of food concerning which it is acquiring knowledge; and the fact that this knowledge is oscillating and vacillating in its progress toward the real and the full truth will stimulate its every alert member (if this perfection of college classes may be expected) to thinking for himself on the problems and the means of solving them. Then, as formerly, we shall rely on such self-guidance rather than on mimeographed mechanical outlines of work.

Here, in the class-room—even without laboratories, greenhouses or herbaria or gardens—lies our own personal point of contact with the relation of botany or of any science to agriculture—or to anything else. The inspiration of an enthusiastic teacher, an indefatigable investigator, an aging man who never can become encysted by age but whose horizon increases with the years is the contribution of college and university that develop it. These are the men who make laboratories, who devise means to ends—whom others follow.

WILLIAM TRELEASE
UNIVERSITY OF ILLINOIS

ON THE AVIFAUNA OF THE CAPE VERDE ISLANDS[1]

RECENT field work for the American Museum of Natural History has supplied specimens and data for a study of the bird life of the Cape Verde Islands. Water birds, in particular, are so well represented in the collection that it has been possible to employ statistical methods in determining the range of individual variation in certain species, and to contrast, by means of frequency graphs, variation of this kind with geographic variation, *i. e.*, true specific or subspecific variation.

The avifauna of the Cape Verde group comprises 75 forms, of which 37 are seasonal or casual visitants from breeding grounds elsewhere, and three are introduced species. Of the 35 native resident birds, 9 are oceanic, while 8 may be considered Palearctic, 7 Ethiopian and 11 neutral.

The last and largest of these assemblages includes birds of five classes, namely: (1) Those whose breeding ranges extend from areas north of the Mediterranean southward into Africa (*e. g.*, the flamingo and the Egyptian vulture); (2) those which range even south of the forest belt in parts of Africa, but which breed also from southern Europe eastward into Asia (*e. g.*, the white egret, which is resident in India and Ceylon); (3) those which are alike related to representative forms to northward and to southward (*e. g.*, the endemic courser and barn owl, the latter of which is a member of an almost cosmopolitan species); (4) those characteristic of the northerly part of the desert zone, some of which have close relatives in Egypt, Arabia or southwestern Asia (*e. g.*, a lark, *Alaemon*, and a raven, *Corvus ruficollis*); (5) those which have a large proportion of their congeners in South Africa, but which, nevertheless, show closest affinity with species found at the northern edge of the Sahara (*e. g.*, a lark, *Ammomanes*, etc.).

The avifauna is therefore neither prevailingly Palearctic, as Wallace believed, nor distinctly Ethiopian, as has been held by more recent naturalists.[2] It is rather a transition fauna, with numerous desert types akin to birds found along the northern border

[1] Abstract of a paper read before the New York Academy of Sciences on December 10, 1923.

[2] Wallace, A. R., 1876. "The Geographical Distribution of Animals," I, pp. 214, 215. Neumann, O., 1918. *Journal für Ornithologie*, LXVI, pp. 235, 236. Bannerman, D. A., 1920, *Ibis*, pp. 560, 561.

of the Sahara, and with a high proportion of endemism—more than 40 per cent.

Even more indicative of the desert affinities of the insular bird life is the fact that most of the distinctly Ethiopian types have their nearest continental relatives not in the neighboring Congo forest toward the southeast, but rather in an encircling belt of territory which forms a loop around the forest in East Africa and extends into South Africa. Thus, an endemic finch of the Cape Verdes (*Passer jagoensis*) is closely related to *Passer cordofanicus* of the upper White Nile, *Passer ruficinctus* of East Africa, and *Passer motitensis* of the arid parts of South Africa, while no representative occurs in the Congo.

In both relative position and zoogeographic aspects, the Cape Verde Islands are somewhat analogous to the Galapagos Islands, situated westward of South America, in a lower latitude and in a different meteorological environment.

The Cape Verdes owe their prevailing aridity chiefly to the fact that they are tropical islands which lie to leeward of relatively cool ocean waters. The group is truly oceanic, with a flora and fauna derived from elsewhere after the volcanic formation of the islands.

Meteorological and oceanographic conditions resulting from the northeast trade wind cause the mean temperature of the surface of the ocean about the Cape Verde Islands to be lower than that of the atmosphere. This is at variance with conditions in the western tropical and north temperate Atlantic, and is correlated with significant features of sea bird distribution. Thus the islands are the northernmost outpost in the eastern Atlantic of the breeding range of tropical Steganopodes (booby, tropic bird, and frigate bird), whereas all these birds reach higher latitudes in the western Atlantic. In like manner, the tropical species of terns penetrate much farther north in the western than in the eastern part of this ocean. To express the difference by an example, it may be said that the hiatus between the breeding ranges of a tropical tern, *Anous stolidus,* and a Holarctic tern, *Sterna hirundo,* is fifteen hundred miles wide in the eastern Atlantic, and less than six hundred miles wide in the western Atlantic. At the Cape Verdes there are no native terns or other Laridae.

These circumstances undoubtedly have to do with marine ecology, for the limits in the breeding range of both tropical and north temperate sea birds prove to be closely correlated with certain isotherms of ocean temperature.

ROBERT CUSHMAN MURPHY
AMERICAN MUSEUM OF NATURAL HISTORY

SCIENTIFIC EVENTS

THE TORONTO MEETING OF THE BRITISH ASSOCIATION

OVERSEA members of the British Association for the Advancement of Science coming to the Toronto meeting, beginning on August 6, include the following:

Section G—Engineering

President—G. W. O. Howe, James Watt professor of electrical engineering, University of Glasgow, and editor of the *Radio Review.* His presidential address will deal with "A hundred years of electrical engineering."

Vice-president—Sir Henry Fowler, chief mechanical engineer of the Midland Railway, will speak on "Metallurgy and its influence on social life."

Recorder—F. C. Lee, professor of civil engineering, University of Birmingham.

Secretary—A. Robertson, professor of mechanical and mining engineering, University of Bristol.

Secretary—J. S. Wilson.

T. Hudson Beare, Regius professor of engineering and dean of the faculty of science of Edinburgh University.

Henry Borns.

Ernest J. Coker, professor of civil and mechanical engineering, University of London.

G. Cook, professor of mechanical engineering, King's College, University of London.

George Forbes, late electrical engineer for the works at Niagara Falls.

B. P. Haigh, professor at Royal Naval College, Greenwich.

Sir James B. Henderson, adviser in gyroscopic equipment to the Admiralty, and professor of applied mechanics, Royal Naval College, Greenwich.

Charles Frewin Jenkins, professor of engineering science in the University of Oxford.

Sir William John Jones.

Edgar Waldorf Marchant, professor of electrical engineering, University of Liverpool.

Hon. Sir C. A. Parsons, chairman of the C. A. Parsons Company, Newcastle-on-Tyne, and the Parsons Marine Steam Turbine Company. Past president of the British Association.

H. P. Philpot, professor of civil and mechanical engineering in the City and Guilds Technical College, London.

Section M—Agriculture

President—Sir John E. Russell, director of the Rothamsted Experiment Station, England, will deliver his presidential address on the subject of "Combination in attacking farmers' problems" and will discuss "Diminishing returns in agriculture."

Vice-president—Charles Crowther, director of research, Olympia Agricultural Company; formerly professor of agricultural chemistry, and head of the Institute for Research on Animal Nutrition in the University of Leeds.

Recorder—C. J. T. Morison, School of Rural Economy, Oxford.

Secretary—T. S. Dymond, London.

Secretary—G. Scott Robertson, head of the chemical research division, Ministry of Agriculture and chief agricultural analyst for Northern Ireland.

Rt. Hon. Lord Charles Bathurst Bledisloe, chairman of the committee for agricultural research, Bristol University, will discuss "Diminishing returns in agriculture," in joint discussion with Section F.

A. W. Borthwick, on staff of Forestry Commission, England.

Malcolm Janes Rowley Dunstan, principal of Royal Agricultural College, Cirencester.

R. A. Fisher, chief statistician in Rothamsted (Agricultural) Experiment Station, Harpenden, Herts.

Sir Robert Blythe Greig, chairman of the Board of Agriculture for Scotland.

Sir John McFadyen, principal and professor of comparative pathology, Royal Veterinary College, London, will speak on "Contagious abortion in relation to animal husbandry."

Sir Henry Rew, formerly assistant secretary of the Board of Agriculture and Fisheries.

Sir Stewart Stockman, chief veterinary officer and director of veterinary research with the Ministry of Agriculture and Fisheries, will speak on "Tuberculosis in relation to animal husbandry."

R. G. White, professor of agriculture in the University College of North Wales, Bangor.

THE ITHACA MEETING OF THE AMERICAN CHEMICAL SOCIETY

THE sixty-eighth meeting of the American Chemical Society will be held at Cornell University, Ithaca, N. Y., from September 8 to 13. The first day will be occupied with registration and council meetings. The general program follows:

SEPTEMBER 9, 9:30 A. M.

Bailey Hall—general meeting. Dr. Livingston Farrand, president of Cornell University, presiding.

Addresses of welcome.

Response: Dr. Leo Baekeland, president of the American Chemical Society.

General addresses. Sir Max Muspratt, "Chemistry and civilization"; Professor S. P. L. Sorensen, "Serum globulins"; Sir Robert Robinson, "The chemistry of the trinitrotoluenes."

2:30 P. M.

Baker laboratory, main lecture room.

Description of the laboratory: Dr. L. M. Dennis, director of the department of chemistry, Cornell University.

Inspection of laboratory, equipment and exhibits.

8:30 P. M.—Bailey Hall

Entertainment for members and guests.

SEPTEMBER 10, 9:30 A. M.

General meetings of physical and inorganic, industrial and chemical education divisions. Divisional meetings.

8:30 P. M.

Bailey Hall—President Leo H. Baekeland, presidential address; President Livingston Farrand, public address. (Titles to be announced.)

SEPTEMBER 11, 9:30 A. M. AND 2:30 P. M.

Divisional meetings. Evening open.

SEPTEMBER 12, 9:30 A. M.

Divisional meetings.

2:45 P. M.

Boat from foot of Buffalo Street to Salt Works, Taughannock and Glenwood Hotel or tennis, golf and other diversions.

7:00 P. M.

Dinner and dance at Glenwood-on-Cayuga.

SEPTEMBER 13, 9:00 A. M.

Trips to points of industrial or scenic interest.

The following are the addresses of the divisional and sectional secretaries:

Agricultural and food chemistry, C. S. Brinton, U. S. Food Inspection Station, 134 S. 2nd St., Philadelphia, Pa.

Biological Chemistry, R. A. Dutcher, Department of Agricultural Chemistry, Pennsylvania State College, State College, Pa.

Cellulose chemistry, L. F. Hawley, Forest Products Laboratory, Madison, Wis.

Chemical education, Neil E. Gordon, University of Maryland, College Park, Md.

Dye chemistry, R. Norris Shreve, 74 S. Munn Ave., East Orange, N. J.

Fertilizer chemistry, H. C. Moore, Armour Fertilizer Works, 209 W. Jackson Blvd., Chicago, Ill.

Industrial and engineering chemistry, E. M. Billings, Kodak Park, Rochester, N. Y.

Leather and gelatin chemistry, Arthur W. Thomas, Department of Chemistry, Columbia University, New York City.

Chemistry of medicinal products, H. A. Shonle, 115 E. 28th St., Indianapolis, Ind.

Organic chemistry, J. A. Nieuwland, Notre Dame, Ind.

Petroleum chemistry, G. A. Burrell, Columbia Bank Building, Pittsburgh, Pa.

Physical and inorganic chemistry, H. B. Weiser, Rice Institute, Houston, Tex.

Rubber chemistry, Arnold H. Smith, 6748 Newgard Ave., Chicago, Ill.

Sugar chemistry, Frederick J. Bates, Bureau of Standards, Washington, D. C.

Water, sewage and sanitation chemistry, F. R. Georgia, Department of Chemistry, Cornell University, Ithaca, N. Y.

Gas and fuel section, O. O. Malleis, 333 Melwood St., Pittsburgh, Pa.

History of chemistry section, L. C. Newell, 688 Boylston St., Boston, Mass.

Paint and varnish section, W. T. Pearce, N. D. Agricultural College, Agricultural College, N. D.

THE COST OF GERMAN PUBLICATIONS

THE following resolution was unanimously adopted at the twenty-seventh annual meeting of the Medical Library Association, held in Chicago, Illinois, on June 9 and 10:

WHEREAS many of the German publishers of medical books and periodicals are making unreasonable and unjustifiable charges for their publications to foreign subscribers and especially discriminating against American subscribers,

Therefore, be it resolved that it is the sense of this meeting that the Medical Library Association go on record expressing its disapproval of this unfair discrimination and urging the library and individual members of the association to discontinue the purchase of German medical books and periodicals until such time as the German publishers adopt a more equitable policy toward the American subscribers regarding prices; and further urging the discontinuance entirely of the purchase of all German books and periodicals unless prompt evidence is given of a change of attitude on the part of the German publishers and agents.

Therefore, be it further resolved that a copy of these resolutions be sent to every library and individual member of the Medical Library Association and to our American Consul General in Berlin, to Mr. M. L. Raney, chairman of the American Library Association Committee on Book Buying, and to the editors of the following periodicals for publication: *Journal of the American Medical Association, Borsenblatt des deutschen Buchhandels, Publishers Weekly, The Library Journal, Public Libraries,* SCIENCE.

Committee on resolution regarding prices of German Medical Publications,

CHARLES FRANKENBERGER, *Chairman,*
J. CHRISTIAN BAY,
CHARLES PERRY FISHER

THE AMERICAN ASSOCIATION AND THE NAPLES ZOOLOGICAL STATION

THE grant made by the American Association for the Advancement of Science to the Zoological Station at Naples has been accepted, and the director of the station, Dr. Reinhard Dohrn, has expressed his appreciation of the grant in the following paragraph taken from a letter to the permanent secretary:

I have received your letter communicating to me the vote of the American Association for the Advancement of Science to grant $500 for an American working table at our Zoological Station, and I wish to tender herewith my heartiest thanks for this very valuable material help to our institute, and particularly for the moral support coming from such a highly representative body as the American Association for the Advancement of Science. My collaborators and I, who are just engaged in bringing the Zoological Station again to an efficient working order, do highly appreciate this encouragement of American Science to our endeavors and I trust that the Zoological Station will succeed in rendering again good service to American biologists as it had been our privilege in the past.

The association wishes to name an occupant for the working table at Naples, and the permanent secretary will be glad to receive applications from scientists who may wish to take advantage of this. Dr. Dohrn states that he will be glad to correspond with persons who are planning to work at the Naples station.

BURTON E. LIVINGSTON,
Permanent Secretary

SCIENTIFIC NOTES AND NEWS

ROBERT MELDRUM STEWART has been appointed director of the Dominion Observatory at Ottawa in succession to the late Dr. Otto Klotz.

ANDREW THOMSON has been appointed director of the Apia Observatory, Western Samoa, under the administration of the New Zealand government.

DR. FLORENCE R. SABIN, professor of histology at the Johns Hopkins Medical School, has been appointed a member on the scientific staff of the Rockefeller Institute for Medical Research.

THE Franklin medal and certificate of honorary membership in the Franklin Institute awarded to Sir Ernest Rutherford, Cavendish professor of physics at the University of Cambridge, was presented at a special ceremonial, held in London, on July 14.

DR. WILLIAM H. WELCH, director of the School of Hygiene and Public Health, Johns Hopkins University, has sailed for Europe to attend the conference on public health at Geneva.

DR. SAMUEL T. DARLING, of the International Health Board of the Rockefeller Foundation, was elected president of the American Society of Tropical Medicine at the annual convention held from June 9 to 10, in Chicago.

F. M. FARMER, chief engineer of the Electrical Testing Laboratories, New York, was elected president of the American Society for Testing Materials at the recent convention held in Atlantic City.

DR. P. S. HELMICK, of Drake University, has been elected secretary of the Iowa Academy of Science in succession to James H. Lees, of the Iowa Geological Survey, who has resigned after ten years of service.

PROFESSOR G. FICHERA, of the University of Pavia, has been awarded the Santoro prize by the National Academy of Sciences at Rome, for his researches on cancer.

RAPHAEL ZON, director of the Lake States Forest Experiment Station, has been appointed corresponding secretary of the Finnish Forestry Society, the object of which is to promote scientific forest investigations in Finland.

THE St. Louis office of the Bureau of Mines, Department of the Interior, was discontinued on July 1. C. E. Van Barneveld, superintendent of the Mississippi Valley Station, Rolla, Mo., with which the St. Louis office was connected, has resigned. B. M. O'Harra is acting as superintendent of the Rolla Station.

AN office of the petroleum division of the Bureau of Mines is being established at the University of Wyoming. D. B. Dow, who has been attached to the Petroleum Experiment Station at Bartlesville, Okla., will be the engineer in charge of the Laramie office.

DR. GEORGE H. GODFREY, who was for ten years in the United States Bureau of Plant Industry, has accepted a position in agricultural research with the Beyer Company, New York.

G. H. CHENEY, formerly an instructor in chemistry at the University of Illinois, is now employed as a research chemist with the Dow Chemical Co.

SAMUEL F. HILDEBRAND, of the United States Bureau of Fisheries, left early in June for Augusta, Ga., from which point he will continue the investigation of fishes in relation to mosquito control in cooperation with the Public Health Service.

DR. CHARLES W. HARGITT, research professor of zoology, Syracuse University, has been invited to membership in the Pan-American Scientific Congress which meets in Lima, Peru, in November next, by the president and secretary general, on behalf of the organization committee. Dr. Hargitt will submit to the congress a report on some recent investigations.

PROFESSOR G. W. RITCHEY, of the Carnegie Solar Observatory, California, gave an illustrated lecture at the general meeting of the Astronomical Society of France held at the Sorbonne on June 18.

A GIFT of $1,000 to establish a trust fund in memory of their son, Carl G. Kremers, has been received by the University of Wisconsin from Professor and Mrs. Edward Kremers. Professor Kremers is director of the university course in pharmacy and of the Pharmaceutical Experiment Station. The fund will be used by the station for research in furtherance of chemotherapy.

THE *Journal* of the American Medical Association states that the statue erected in memory of the anatomist Farabeuf has just been unveiled at the Faculty of Medicine of Paris. Addresses were delivered by Professor Sébileau, a former pupil of Farabeuf, in the name of his colleagues of the Faculty of Medicine; Professor Lejars, as the representative of the Academy of Medicine, and Professor J. L. Faure, in behalf of the Société de Chirurgie.

WE learn from *Nature* that at the University of Leeds, England, a fund has been raised with the object of signalizing the distinguished services which Professor Arthur Smithells had rendered to the community and particularly to the science of chemistry and the University of Leeds during his thirty-eight years' tenure of office as professor of chemistry. A portrait is to be painted of Professor Smithells for presentation to the university, and a fund of at least £2,000 will remain for the endowment of a scholarship.

DR. DUDLEY A. SARGENT, president and founder of the Sargent School for Physical Education, Cambridge, and formerly director of the Hemenway Gymnasium of Harvard University, died on July 21, in his seventy-fifth year.

DR. HARVEY R. GAYLORD, for twenty-five years director of the State Institute for the Study of Malignant Diseases at Buffalo, died on June 23, at the age of fifty-two years.

DR. WILLIAM ALPHONSO WITHERS, professor of chemistry in the North Carolina State College of Agriculture and Engineering since its establishment in 1889, died suddenly on June 20, at the age of sixty years.

PROFESSOR PHILIP B. HASBROUCK, for twenty-nine years head of the department of physics at Massachusetts Agricultural College, has died.

DR. CHARLES E. MOYSE, emeritus vice-principal of McGill University, Montreal, and emeritus dean of the faculty of arts, has died at the age of seventy-two years.

SIR WILLIAM ABBOTT HERDMAN, formerly professor of natural history and oceanography at the University of Liverpool, and one of the best known marine biologists in Great Britain, died on July 22.

THE legislature having recently authorized the change, Dr. E. N. Lowe, state geologist of Mississippi, is now transferring the museum and the library of the State Geological Survey from Jackson to the State University. The address of the survey will henceforth be University, Mississippi.

THIRTEEN professors and instructors of various universities and colleges attended the fourteenth annual session of the Summer Conference for Engineering Teachers, which was held at the works of the Westinghouse Electric and Manufacturing Company from July 7 to July 31. The program for the conference was worked out so that each member was afforded an opportunity to carry out some line of engineering work. Among the colleges represented

in the conference are the University of Kansas, University of Colorado, New Mexico Agriculture and Mechanics College, Alabama Polytechnic Institute, Harvard Engineering School, Cornell University, University of Iowa, Oregon Agricultural College, Brooklyn Polytechnic Institute, Purdue University and the Victoria Jubilee Institute of Bombay, India.

THE Medical Research Council of London announces that it has awarded Rockefeller Medical Fellowships, tenable in the United States during the academic year 1924–25, to the following: Robert Keith Cannan, senior assistant in biochemistry, University College, London; John Josias Conybeare, assistant physician and warden of the College at Guy's Hospital, London; Dr. James Rognvald Learmonth, assistant to the professor of surgery, Anderson College of Medicine, Glasgow; Ethel Marjory Luce, Lister Institute of Preventive Medicine, London; Dr. John William McNee, senior assistant in the medical unit, University College Hospital, London; William Robson, chemical assistant in the department of therapeutics, University of Edinburgh.

SECRETARY OF THE NAVY WILBUR has approved a project of the Naval Observatory for sending an expedition to observe the total solar eclipse in Sumatra in January, 1926. From the observations to be made it is believed that valuable data will be obtained regarding magnetic disturbances on the sun.

THE International Medical Commission for combating malaria has arrived at Warsaw. The commission, which was appointed by the League of Nations, will proceed later to Russia to continue its researches and inquiries.

THE California Academy of Sciences is sending a collecting party from its department of entomology into the southern Arizona mountains to collect and study the Sonoran fauna of this region. The party will be in charge of E. P. Van Duzee, curator of entomology in the academy, assisted by J. O. Martin. They will leave San Francisco about the fifteenth of July and remain in the field from four to six weeks, visiting the Santa Catalinas, the Huachucas and possibly others of the southern mountains.

AN expedition into the little known parts of China will be conducted for the next two or three years by explorers of the Department of Agriculture. Dr. P. H. Dorsett and his son, J. H. Dorsett, sailed from San Francisco for Shanghai on July 22. Their explorations will be conducted in the Provinces of Chih-Li and Shen-Si and in the rich agricultural territory of Manchuria. They will make intensive studies of agricultural conditions and the principal crops with a view to ascertaining in what way a mutual exchange of seeds and plants can be brought about between China and the United States.

UNIVERSITY AND EDUCATIONAL NOTES

A CABLEGRAM reports that the movement to establish an American university in Greece similar to Robert College in Constantinople has been given impetus by the visit to Athens of Professor Robert Andrews Millikan, director of the Norman Bridge Laboratory of the California Institute of Technology at Pasadena. Professor Millikan is reported to be representing a foundation which has allocated $5,000,000 for such a project.

DR. R. AHMED, a graduate of the University of Iowa, has opened a dental college in Calcutta, to be called the Calcutta Dental College and Hospital. The staff of twelve members includes a second Iowa alumnus, Dr. P. K. Bose.

DR. RALPH S. LILLIE, of the Nela Research Laboratory, Cleveland, has been appointed professor of physiology at the University of Chicago. In addition to the appointment of Dr. Karl Taylor Compton to be professor of physics, as previously recorded in SCIENCE, other appointments include: Dr. G. K. K. Link, associate professor of plant pathology; Dr. Frank E. Ross, associate professor of astronomy at the Yerkes Observatory; Dr. William Taliaferro, associate professor in the department of hygiene and bacteriology; Dr. Fay-Cooper Cole, assistant professor of anthropology, and Dr. H. B. Van Dyke, assistant professor of physiological chemistry.

DR. EARLE R. HEDRICK, who has been for twenty-three years professor of mathematics at the University of Missouri, has resigned to become professor of mathematics at the University of California at the southern branch in Los Angeles.

DR. C. S. YOAKUM, who five years ago succeeded Dr. W. D. Scott as director of the Bureau of Personnel Research at Carnegie Institute of Technology, has been appointed professor of personnel management in the newly organized School of Business Administration at the University of Michigan.

DR. JOHN DUDLEY DUNHAM was recently appointed professor of medicine in the college of medicine of the Ohio State University.

DR. A. C. WALTON, formerly professor of zoology at Northwestern College, Naperville, has been appointed professor of zoology at Knox College to succeed Dr. George N. Higgins, who goes to the Mayo Foundation at Rochester to take up research work in comparative anatomy.

PROFESSOR ROBERT H. GAULT, of Northwestern University, who will be associated with the National Research Council at Washington during the year 1924–

1925, will give a graduate course in the psychology of the handicapped at George Washington University. His place in Northwestern University will be filled by Professor A. R. Gilliland, of Lafayette College.

A. R. CAHN, PH.D. (Illinois, '24), and F. B. Adamstone, Ph.D. (Toronto, '24) have been appointed instructors in zoology at the University of Illinois.

DR. REYNOLD KENNETH YOUNG, of the Ottawa Observatory, has been appointed associate professor of astronomy at the University of Toronto.

DR. B. B. BAKER, of the University of Edinburgh, has been appointed to the university chair of mathematics at University College, London, tenable at the Royal Holloway College.

DR. MANGIAGALLI, senator and director of the postgraduate work at Milan, has been elected rector of the newly organized university there.

DISCUSSION AND CORRESPONDENCE

DETERMINATION OF "e" FROM MEASUREMENTS OF THE SCHROTT-EFFECT

SCHOTTKY[1] has calculated, under the name "Schrott-effect," the spontaneous variations in thermionic currents that are to be expected if electron evaporation follows the law of probability. These variations depend upon the value of "e". Hartmann[2] attempted to determine "e" by measuring these variations. He succeeded in amplifying the variations to audibility, and by subjective comparison with pure tones of known intensity obtained values of "e" which varied from one fifteenth the accepted value to three times this value.

We have repeated these measurements, using a radio-frequency amplifier instead of audio-frequency, thus avoiding disturbances due to gas effects or mechanical shocks; and using a "square" vacuum tube detector and d.c. ammeter to measure directly the energy of the Schrott disturbance. *The values of "e" calculated from these measurements are all within 2 per cent. of the accepted value, and the mean differs by less than one half per cent. from this value.*

Schottky's theory is thus fully substantiated, and it appears possible that this method of measuring "e" may yield values comparable in accuracy with the oil-drop method.

The Schrott variations appear to be the same for all types of cathode (pure tungsten, thorium coated tungsten, etc.) provided the current is limited by temperature. *When the current is limited by space charge instead of temperature, however, the Shrott-variations are much smaller.* This is in accordance with the theory, since under space charge conditions the electrons no longer fly off independently, but influence each other in such a way as to smooth out the variations.

ALBERT W. HULL
N. H. WILLIAMS

GENERAL ELECTRIC COMPANY
SCHENECTADY, N. Y.

[1] Schottky, *Ann. d. Phys. 57*, 541–67, 1918; *68*, 157–76, 1922.

[2] C. A. Hartmann, *Ann. d. Phys. 65*, 65, 1921.

AN OSMOSIS EXPERIMENT IN BIOLOGY

IT is customary in an elementary course in biology to set up a demonstration of osmosis. Sometimes the thing does not work. A biology teacher usually performs it as a side line to the regular course work and seldom has time to experiment when it fails.

We have tried various grades of parchment, not always with good result. The solutions would exchange too fast in some cases. Other grades proved impermeable. Our best results have been with chicken crop. The smooth side is put out.

When the craw proves impermeable, the outside should be scraped and 5 per cent. HCl be painted on with a brush. A rise to six feet can then be obtained. I hope this may prove of service to some who have met with troubles.

HAROLD D. CLAYBERG

UNIVERSITY OF ARIZONA

LETTERS OF RAFINESQUE

APROPOS of the note on "The Bones of Rafinesque" in the issue of SCIENCE for June 20—it may be of interest to those who care to delve in scientific biography—to know there is on deposit at the Philadelphia Academy of Natural Sciences the Haldeman letters and correspondence which contains the personal letters of Rafinesque, pertaining to his early life not only in America but in Europe. It is a veritable mine of information for any one who may care to prepare a biography of this remarkable character.

JOSEPH LEIDY, II

SCIENTIFIC BOOKS

I. Descriptions and Biology of New or little known Coccids from Japan. By INOKICHI KUWANA. II. *Observations on the Hymenopterous Parasites of Ceroplastes rubens Mask., with Descriptions of New Genera and Species of the Subfamily Encyrtinae.* By TEI ISHII (Dept. Agr. and Comm. Japan, Imp. Plant Quar. Sta., Bull. 3, Aug. 1923, p. 1–68, pl. I–XIV, fig. 1–5 (Art. I.) and pp. 69–114, pl. XV–XIX (Art. II.).

THERE are only three existing copies of this paper, the remainder of the edition having been destroyed by the Japanese earthquake of September 1, 1923. Two of these have been retained in Japan, while the third was brought to Dr. L. O. Howard, chief of the Bu-

reau of Entomology, by Mr. C. P. Clausen, parasite expert of the bureau, at the request of Professor Kuwana. It is to be hoped that the paper will be reprinted eventually, but since several new Japanese species of scale insects and hymenopterous parasites have been described in the paper it seems desirable to give a brief statement as to its contents.

The new species of Coccidae described are the following: *Prontaspis yanonensis,*[1] a close relative of *Chionaspis citri* Comst., from many species and varieties of *Citrus; Geococcus citrinus,* the second representative of this peculiar Pseudococcine genus, on roots of orange; *Rhizoecus kondonis,* another Pseudococcine species, from the roots of orange trees, and *Orthezia yasushii,* stated to occur on wild chrysanthemum and *Artemisia vulgaris.* In addition, the three species of *Ceroplastes* occurring in Japan, *rubens,* Mask., *floridensis* Comst., and *ceriferus* (And.), and *Geococcus oryzae* (Kuw.), previously considered to be a *Ripersia,* are discussed at length. An extended description of the different stages, accompanied by numerous quite satisfactory figures, is given for each species, and the description is supplemented by a discussion of the biology and host relationships of the species where information on these has been obtained.

The second article in this bulletin, as indicated by the title, consists in part of a consideration of the hymenopterous enemies of the introduced coccid, *Ceroplastes rubens,* and in part of technical descriptions of new Encyrtids. An extended discussion of the biology, habits, host relations and economic importance of the two species *Micropterys speciosus,* described as new, and *Coccophagus lecanii* Fitch is given, together with descriptions, accompanied by figures, of the different stages of each species. The general conclusion is reached that neither is effective in checking the increase and spread of the coccid host.

The second part of the paper describes the following new genera and species of Hymenoptera, all from Japan: *Clausenia,* new genus, and *C. purpurea,* new species, reared from *Pseudococcus* sp. on Citrus; *Neocopidosoma,* new genus and *N. komabae* new species, from a Tortricid larva on *Elaeagnus; Cheiloneurus ceroplastis,* new species, from *Ceroplastes rubens* and *C. ceriferus; Anabrolepis japonica,* new species, swept from bamboo infested with *Eriococcus onukii; Anabrolepis bifasciata,* new species, collected by sweeping: *Aphycus timberlakii,* new species, from *Lecanium* sp. on *Euonymus; Microterys ericeri,* new species, from *Ericerus pe-la* on Ligustrum.

HAROLD MORRISON

BUREAU OF ENTOMOLOGY,
WASHINGTON, D. C.

[1] First described (in Japanese) as *Chionaspis yanonensis* (Byokin Giachu Iho. Bur. Agr. D. H. Agr. and Comm. Japan, No. 10, 1923, pp. 1–33).

SPECIAL ARTICLES

GLACIAL PEBBLES IN EASTERN KENTUCKY[1]

WITHIN the last year (1923–24) the discovery of erratic pebbles of apparent glacial origin widely distributed throughout northeastern Kentucky has provided the first concrete evidence in support of a hypothesis of Pleistocene glacial ponding in a part of Kentucky heretofore thought to be without glacial characteristic. The occurrence of old elevated stream channels along the Ohio, notably at Huntington, West Virginia; Ashland, Kentucky; Ironton, Wheelersburg and Portsmouth, Ohio, has been known for some time, having been described by Leverett[2] and Tight.[3] These abandoned channels occur at elevations ranging from 680 feet to 690 feet above sea level. While they contain gravels chiefly composed of quartzite and chert of stream origin, possibly more remotely glacial, they are not to be confused with the pebbles which are now being found in remote parts of eastern Kentucky at much higher elevations.

In the course of non-glacial field work geologists on the Kentucky Geological Survey, including the writer, have found 18 pebbles varying in size from a few ounces to 13 pounds, consisting principally of quartzites, but with an occasional granite, gneiss or other crystalline or metamorphic rock. These pebbles range in elevation from 720 feet on the Big Sandy River to 850 feet on the North Fork of the Licking River, and have been found in Lawrence, Elliott, Lewis, Morgan, Carter and Boyd counties. Field evidence indicates that similar pebbles may also be found at similar elevations in parts of Menifee, Greenup and Rowan counties, though these are not a certainty. The drainage systems involved in these discoveries include the Big Sandy River, Little Sandy River and Tygarts Creek, and the North and Elk Forks of the Licking River.

Based on evidence now in hand, which will be supplemented this year by further investigations, the following hypothesis is advanced:

The general accordance of elevations of these pebbles coupled with their certain extraneous origin and decidedly glacial characteristic suggests their invasion into Kentucky by means of floating ice. It is held that they probably represent a complex assortment derived from both river and glacial front sources during the period of readjustment of the northward flowing drainage of this portion of the Cumberland plateau, while cols were being degraded to form the present course of the Ohio River at points just above (1) Ironton, (2) Portsmouth and (3) Manchester, Ohio, and possibly just above Cincinnati. It is

[1] Presented before the Kentucky Academy of Science, Lexington, Ky., May 10, 1924.

[2] Monograph XLI, U. S. G. S., p. 106, 1902.

[3] Prof. Paper No. 13, U. S. G. S., Plate XV2, 1903.

thought that the higher and more remote pebbles (800 to 850 feet) represent invasions by floating ice at the time of the first cutting of the Manchester col, which may have been originally about 850 or 900 feet. Ridges in the vicinity of Manchester now show elevations ranging up to 1,000 feet above sea level. Pebbles occurring in Kentucky at points near to the major drainage at elevations ranging from 720 to 750 feet are taken to represent subsequent ponding during the latter cutting of the Manchester col, and possibly those at Ironton, Portsmouth and Cincinnati. Ridge elevations at Ironton now range between 800 and 850 feet; at Portsmouth between 900 and 950 feet; and at Cincinnati (Dayton, Kentucky-Walnut Hills, Ohio) between 850 and 860 feet.

The section involved in this ponding in eastern Kentucky has not been topographically mapped except in part. Barometric elevations run throughout this section indicate that the highest ridges will range from 1,000 to 1,200 feet. At the highest level of ponding, ridge topography in this section would have appeared insular, the region resembling somewhat the Thousand Islands region of the St. Lawrence. A study of the elevations of these pebbles, their position and the gradient of some high level fluvatile gravels and terraces may possibly bring out the fact of uplift in the southwestern part of the section subsequent to the Pleistocene. The period of ponding at an elevation of 850 feet appears to have been short, as terraces apparently were not widely developed. There is no evidence now in hand to prove the extension of glacial ice lobes into this part of the state. Stratified drift is absent and ridge topography does not show a general beveling. Ponding in northeastern Kentucky at this time very possibly covered an area of about 2,000 square miles.

The occurrence of pebbles at high levels on that part of the drainage of the Licking River which adjoins the Little Sandy River may mean (1) that these ponded glacial waters flowed over one or more low divides in this interior part of Kentucky, and (2) that these southern cols were in direct competition for a time at least with those which were removed at such northern points as Manchester and elsewhere. To accept this theory the assumption of regional uplift in Morgan County and vicinity during and subsequent to the Pleistocene becomes a necessity. Yet this assumption would seem to be far more plausible than (1) a high damming of the Licking River and (2) glacial ice floating southeastward along the serpentine course of the Licking over 100 miles to the Elliott County line.

If the Morgan–Elliott County passes thus brought into prominence were indeed temporary debouchures for impounded glacial waters, to the superior hardness of the lower Pottsville clastics of this region and some coincident regional uplift may be ascribed the present course of the Ohio River bordering northeastern Kentucky. Had the Coal Measure sediments of Morgan and Elliott counties less competently met the erosive action of surging glacial waters the course of the then formative Ohio River would undoubtedly have been directed up the valley of the Little Sandy River and down the Licking River. Such a hypothetical change in the pattern of the Ohio River would have (1) reduced the area of Kentucky by 2,500 square miles, (2) placed Lexington, the heart of the Blue Grass Region, within 35 miles of the Ohio, and (3) profoundly altered the history and economics of the entire lower Ohio valley.

WILLARD ROUSE JILLSON
KENTUCKY GEOLOGICAL SURVEY,
FRANKFORT, KENTUCKY

TEMPERATURE AND MUSCULAR EXCITABILITY

THE influence of temperature on muscular excitability is a problem yet unsettled, although numerous investigations on it have been published. Controversy continues among investigators, who have found different optimal temperatures; some place the optimum at or near 30° C., while others have found it at or near 5° C., and still others have determined two optima situated at these two levels.

The majority of investigators have taken the height of the contraction curve as the indicator of muscular excitability. This indicator, however, is not accurate because many factors may modify it. In my experiments I have used the threshold of contraction when induced break shocks, measured by Martin's method[1] in Z units, were applied to the gastrocnemius muscle of the frog. After the animal was pithed the muscle was excised and placed in a moist chamber surrounded by a water-jacket. The Achilles tendon was directly connected to the myograph. Temperature changes were induced gradually to insure a close correspondence between the reading of the thermometer in the moist chamber and the actual state of the muscle. The threshold was assumed when a minimal movement of the lever made its mark on the drum. The changes in the temperature were made in different ways. At times room temperature was the point of departure, and the temperature was lowered or raised gradually. At other times the start was made from high or low temperature. In the course of longer experiments the range was traversed repeatedly; up and down, down and up. A determination of threshold was usually made after each increment or decrement of one degree.

The results which I have obtained prove that the

[1] Martin: "The Measurement of Induction Shocks," New York, 1912.

threshold is lowest when the muscle is at or near room temperature (18–20° C.). Both the rise and the fall in temperature cause a remarkable rise of the threshold. In the following tables the results of two different experiments are given; it is clear that the lowered excitability, as the temperature is increased or decreased, can not be ascribed to fatigue, because the reverse change occurs on returning to room temperature.

TABLE I

Temperature ° C.	Threshold Z units
19 (Room)	19
14	35
9	45
4	71
0	99
5	80
10	60
15	40
20	36
25	43
30	49

TABLE II

Temperature ° C.	Threshold Z units
17 (Room)	29
0	250
5	185
10	54
15	35
20	32
25	40
30	71
35	344

The height of the contraction curve proves not to be related to the degree of muscular excitability, for although *within certain limits* the excursion of the lever is increased by raising or lowering the temperature and beyond these limits is decreased, the threshold of excitation under the same conditions continues to present higher and higher values. Furthermore, the increase in the height of the contraction curve may be only apparent, as shown by Kaiser,[2] who explained it as a consequence of the imperfection of the apparatus commonly used.

Further experiments will be carried out on this subject with currents of longer duration than those used in the present experiments in order to take into consideration the important evidence adduced by Lucas and Mines regarding the relation of the duration of the stimulus to its stimulating value.[3] In view of the results already obtained, however, enough support seems to exist for the following conclusions:

(a) Neither warming nor cooling increases the excitability of frog muscle—instead, they diminish it;

(b) The optimum temperature at which the excitability of frog muscle appears greatest is that at which the muscle has been maintained before the period of experiment, *i.e.*, the room temperature.

This last conclusion agrees with the conception of Abbott,[4] who states that "for every organism there is an optimum temperature at which it grows and thrives best, and this is apt to be the normal temperature in which the organism naturally occurs."

JAYME R. PEREIRA
LABORATORIES OF PHYSIOLOGY,
HARVARD MEDICAL SCHOOL

[2] Kaiser: *Zeitsch. f. Biol.*, 1896, XXXIII, 157.

[3] Lucas and Mines: *Jour. of Physiol.*, 1907, XXXVI, 334.

[4] Abbott: "General Biology," New York, 1914, 244.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE STANFORD UNIVERSITY MEETING OF THE PACIFIC DIVISION

THE eighth annual meeting of the Pacific Division of the American Association for the Advancement of Science, held at Stanford University June 25 to 28, proved to be fully up to the high standard set by previous meetings. In scientific and popular interest, social features and wholesome enthusiasm, the meeting was all that could be desired. The hospitality of the people of Palo Alto and of Stanford University and of the faculty and officers of the university, in the entertainment of the members of the association and visiting friends, was a marked feature of the meeting.

The total registration was 355. Among those in attendance from distant points were Dr. L. O. Howard, chief of the U. S. Bureau of Entomology, Washington, D. C., a former president and for many years the permanent secretary of the association; Dr. J. McKeen Cattell, president of the association; Dr. George Henry Falkiner Nuttall, Quick professor of biology, Cambridge University; and Dr. T. D. A. Cockerell, of the University of Colorado.

GENERAL SESSIONS

Although the formal opening of the meeting occurred on Wednesday, June 25, one of the affiliated societies—the Western Society of Soil Management and Plant Nutrition—began its sessions on Tuesday morning, June 24.

The registration office was opened Wednesday morning. At the noon luncheon on Wednesday a research conference was held, as has been customary. At this conference President David Starr Jordan presided, and the following named persons presented papers: Dr. Herman A. Spoehr, of the Coastal Laboratory, Carnegie Institution, Carmel, California, on "Photosynthesis"; Dr. Ernest C. Dickson, of the Stanford University Medical School, San Francisco, on "Botulism"; Professor James C. Clark, of Stanford University, on "High tension electrical transmission."

On Wednesday evening, the retiring president, Dr. David Starr Jordan, gave an address on "Science and sciosophy,"[1] following which was given a public re-

[1] This address was published in full in SCIENCE for June 27.

ception. On Thursday evening, Dr. George Henry Falkiner Nuttall, Quick professor of biology, Cambridge University, Cambridge, England, gave an illustrated address on "Symbiosis." The address on Friday evening was given by Dr. J. McKeen Cattell, president of the American Association for the Advancement of Science, his subject being "Psychology as a profession."

On Friday evening, about 60 members and guests made an excursion to Mt. Hamilton, where they were the guests of Associate Director Dr. Robert G. Aitken and staff, of the Lick Observatory. On Saturday about 50 biologists and others made a trip to La Honda and the seashore at Moss Beach.

MEETINGS OF AFFILIATED SOCIETIES

Of the 27 societies that are affiliated with the Pacific Division of the association, formal meetings were held by 13, as follows:

American Chemical Society, California, Sacramento and Southern California Sections, at whose meetings the following program was presented:

Some factors controlling the basicity of amines: DALE STEWART.

Carbon monoxide, a product of electrolysis: ALBERT F. O. GERMANN.

The reactivity of liquid phosgene: ALBERT F. O. GERMANN.

The relation between adsorption and the co-precipitation of radium and barium sulphates: W. M. HOSKINS and H. A. DOERNER.

A critical study of the bisulfate fusion for rare metal ores: GEO. W. SEARS and LAWRENCE QUILL.

The activity coefficient of dilute aqueous solutions of hydrogen chloride, thallous chloride and lead nitrate: MERLE RANDALL and ALBERT P. VANSELOW.

The solubility of lead bromide in aqueous salt solutions and the principle of the ionic strength: MERLE RANDALL and WM. V. VIETTI.

The heat capacities of certain aliphatic alcohols: GEO. S. PARKS.

A source of serious error and how to avoid it, in the Scales method for determining nitrates: P. L. HIBBARD.

Soil analysis, its use and abuse: R. R. SNOWDEN.

Some organic reactions in the ammonia system: E. C. FRANKLIN.

Some chemical effects of ultra-violet light: CHAS. W. PORTER.

Anomalous conduct in the oxidation of sodium sulfite: S. W. YOUNG.

Some phases of the chemistry of the wheat berry: CARL L. ALSBERG.

Water resources of the Santa Clara valley: W. H. SLOAN.

(a) *The density and molecular complexity of gaseous hydrogen fluoride;* (b) *Attempts to prepare a fluo-carbonate and their bearing upon the coordination number of carbon:* JOEL H. HILDEBRAND and JOSEPH SIMONS.

AMERICAN METEOROLOGICAL SOCIETY

Under authorization of the council of the American Meteorological Society, at its Washington, D. C., meeting in April, 1924, a meeting of the society was held at Leland Stanford University, Palo Alto, California, June 26 and 27, 1924, in connection with the meeting of the Pacific Division of the American Association for the Advancement of Science.

Forenoon and afternoon sessions were held on June 26, and were presided over by the vice-president of the society, Dr. A. E. Douglass, University of Arizona, Tucson, Arizona, in the absence of the president, Dr. Willis Milham, Williamstown, Massachusetts. In the absence of the secretary, Dr. C. F. Brooks, Clark University, Worcester, Massachusetts, Mr. M. B. Summers, of the Weather Bureau, Seattle, Washington, was appointed secretary *pro tem.*

The following papers were read and discussed:

A study of long range forecasting for California, based on an analysis of past rainy seasons: L. E. BLOCHMAN.

Grassland as a source of rainfall: F. E. CLEMENTS.

Atmosphere and man: C. M. RICHTER.

Some features of the climate of Alaska: M. B. SUMMERS.

Classification of weather types: E. S. NICHOLS.

The climate of Portland, Oregon: EDWARD L. WELLS.

Anticyclonic weather in southern California: DEAN BLAKE.

Some climatic features of Arizona: ROBERT Q. GRANT.

Seasonal densities and storage of snow: H. F. ALPS.

Notes on the work of the weather bureau: MAJOR E. H. BOWIE.

A telegraphic abstract of a paper entitled "The economic value of climatology," by Ford A. Carpenter, of Los Angeles, California, was read in the absence of the author.

Among the resolutions adopted was one deploring the recent death of Dr. C. Leroy Meisinger, of the Weather Bureau. It follows:

Whereas, recently, in the line of duty and in an earnest effort to learn the secrets of the air and its ways, Dr. C. Leroy Meisinger, a Fellow of the American Meteorological Society, lost his life and meteorology one of its most worthy followers.

Therefore, be it resolved by the members of the American Meteorological Society, assembled at Leland Stanford University, June 26, 1924, that they do express their personal feeling of loss by reason of his untimely death, and their admiration of his efforts to contribute to our knowledge of meteorology; and, be it further resolved, that a copy of this resolution be incorporated in the minutes of the proceedings of this meeting, published in the Journal of the Society, and that a copy be sent to his nearest relative, that it may be known in what esteem he was held by members of the American Meteorological Society.

On Friday, June 27, the society met in joint sessions with the Astronomical Society of the Pacific, with W. S. Adams, of the Mount Wilson Observatory, presiding.

At this session papers were presented as follows:

The sun and atmospheric electricity: FERNANDO SANFORD.

Atmospheric currents observed in large telescopes: A. E. DOUGLASS.

Notes on atmospheric effects on the 100-inch telescope: FRANCIS G. PEASE.

Application of Schuster's periodogram to long rainfall records, beginning 1748: DINSMORE ALTER.

AMERICAN PHYSICAL SOCIETY

This society held sessions on Thursday that were well attended. The papers presented were of unusual interest, as may be judged from the titles which follow:

The growth of snowflakes: experimental evidence: JOHN MEAD ADAMS.

Permeability of magnetite at radio frequencies: JOHN G. KRALOVEC.

The mobility of gas ions in mixtures of ammonia and air: L. B. LOEB and M. F. ASHLEY.

A zone-jet, multi-stage diffusion pump: E. L. HARRINGTON.

Electrometer variations and penetrating radiation: JOSEPH G. BROWN.

Constancy of total photo-current from sodium with temperature change 20 C. to −190 C: ROBERT C. BURT.

Theory of the width of the modified lines in the Compton effect: G. E. M. JAUNCEY.

Soft X-rays: J. A. BECKER and E. L. ROSE.

White light interferometer fringes: W. N. BIRCHBY.

A new type of spectrograph: SINCLAIR SMITH.

Secondary standards of wave-length: HAROLD D. BABCOCK.

Methods for the rapid calculation of power series formulae for band spectra: R. T. BIRGE and J. D. SHEA.

On the simultaneous jumping of two electrons: PAUL S. EPSTEIN.

ASTRONOMICAL SOCIETY OF THE PACIFIC

The Astronomical Society held two sessions on Thursday and a joint session on Friday with the Meteorological Society. On Friday night many of the astronomers and guests visited the Lick Observatory.

Papers were presented as follows:

Note on the extension to Burnham's catalogue of double stars: R. G. AITKEN.

Forthcoming meridian circle publication of the Lick Observatory: R. H. TUCKER.

On possible changes in the short period orbit of Polaris: J. H. MOORE and E. A. KHOLODOVAKY.

Do the star streams of Kapteyn exist? C. V. L. CHARLIER.

Preliminary results from the investigation of the orbit of Comet B1922 (Skjellerup): R. T. CRAWFORD and W. F. MEYER.

The number of solutions in Leuschner's direct method for determining the orbits of disturbed bodies: R. H. SCIOBERETI.

The total solar eclipse of September 10, 1923: A. E. DOUGLASS.

SOCIETY OF AMERICAN FORESTERS, CALIFORNIA SECTION

The joint session of the Society of American Foresters, California Section, with the Ecological Society, was largely dominated by discussions concerning the coming forest. S. B. Show pointed out the difficulties growing from the deliberate attempts to influence the composition of the growing stand through forest management and their relation to ecological principles. The same author, in a second paper, discussed the changes brought about by fires in the California pine forest from transitory brush fields to the reestablishment of a permanent stand different in type and composition from the original. The data presented by J. M. Miller tended to show that the rate of loss from bark beetles in thrifty mature overholders left standing in logging operations is alarmingly high. E. P. Meinecke demonstrated that the logical basis for the evaluation of loss in the young forest from killing diseases such as the white pine blister rust is not the percentage of trees killed but the effect of the killing on the density of the coming stand. *Cronartium pyriforme* was used as an illustration. In a second paper the same author endeavored to establish the physiological background for economic studies of excessive foliage reduction due to defoliating insects and to foliage diseases of fungous origin. Carl L. Alsberg suggested that theoretically the production from plant growth should be greater on a given surveyor's unit of slope than on the same unit of level land. A paper by R. W. Doane gave contributions to the life history and habits of western Ambrosia beetles with special reference to the cultivation and utilization of the Ambrosia mycelium.

Following is a list of papers presented:

Fire as an ecological factor in the pine forests of California: S. B. SHOW.

The management of forest properties in the California pine region as a problem in applied ecology: S. B. SHOW.

Excessive foliage reduction in evergreen coniferous forests: E. P. MEINECKE.

The evaluation of loss from killing diseases in the young forest: E. P. MEINECKE.

Some considerations on the relation between topography and density of vegetation: CARL L. ALSBERG.

Notes on some western Ambrosia beetles: R. W. DOANE.

Some entomological factors affecting future forests: J. M. MILLER.

THE ECOLOGICAL SOCIETY OF AMERICA

The joint symposium with the Western Society of Naturalists, on the morning of June 26, focussed attention upon plant and animal life of chaparral and broad-leaved forest and of grassland in California. Dr. Frank J. Smiley, speaking on chaparral vegetation as developed in southern California, brought out its unique floristic character and its considerable age. Dr. F. E. Clements's paper on native grassland characterized it as more extensive than any other vegetation-type and as well suited to the climatic condition of winter rainfall. Its relation to the grasslands of Arizona and of the prairie region from Miocene time to the present was indicated. These papers and the discussion made it appear that there has not been a recent tendency, due to clearing and other human factors, for grassland to extend its area at the expense of chaparral.

The two papers on the animal life were to bring out the substantial agreement of animals and plants in their response to environmental factors. The unavoidable absence of Dr. J. Grinnell prevented the reading of his paper on vertebrate animals. Dr. E. C. Van Dyke demonstrated that the insect populations of chaparral, broad-leaved forest and open grassland are strikingly different, due in part to direct relations to food plants.

The afternoon meeting with the Society of American Foresters is described in the report for that organization.

On Friday morning, a joint session with the Western Society of Naturalists was held. It is described in the report for that society.

In the Friday afternoon session of the Ecological Society, A. B. Rigg described some sphagnum bogs of the Coos Bay region of Oregon. J. M. Harper, in an account of soil-moisture in the vicinity of Palo Alto, pointed out consistent differences between the coarse soils of chaparral areas and the fine soils of grassland. A. G. Vestal reported on root relations of some California grassland plants. Forrest Shreve gave instances of the workings of depth, slope exposure, color and other factors which determine the temperature of the soil. G. P. Rixford described experiments in growing certain tropical and semi-tropical fruits in favorable situations in California. The cherimoya, sapote blanco, jujube and others seem worthy of trial.

The dinner for biologists on Friday evening was held at the Stanford Union. The field trip to the coast on Saturday was of great interest to members of the Ecological Society.

Following is the full program presented:

SYMPOSIUM: VEGETATION AND THE ASSOCIATED ANIMAL LIFE IN WEST-CENTRAL CALIFORNIA

Joint session with the Western Society of Naturalists

Chaparral and broad-leaved forest vegetation of the southern coast range: FRANK J. SMILEY.

Native grasslands and their significance: FREDERIC E. CLEMENTS.

Vertebrate animal life in relation to the plant environment: J. GRINNELL.

Insect life in relation to the plant environment: EDWIN C. VAN DYKE.

Bird banding as a means in ecological studies: J. E. LAW.

Mutations and the origin of species: DAVID STARR JORDAN.

An excursion to the great barrier reef of Australia: W. E. RITTER.

Gravity as a formative stimulus in plants: G. J. PEIRCE.

Mentioning the mole: T. H. SCHEFFER.

Notes on the breeding of beavers: T. H. SCHEFFER.

The age of the oaks of the Santa Clara valley: JAMES I. W. MCMURPHY.

Color studies of lizards: SARAH R. ATSATT.

The hay-field tarweeds: An application of genetic, ecologic and quantitative methods to the taxonomy of a complex species: H. M. HALL.

Anomalies in the distribution of gulls in California Pleistocene: L. H. MILLER.

The fossil geese of the genus Branta: L. H. MILLER.

Sphagnum bogs of the Coos Bay region of Oregon: GEORGE B. RIGG.

Soil moisture in grassland areas near Palo Alto: J. M. HARPER.

Root relations of some California grassland plants: A. G. VESTAL.

Factors influencing the temperature of the soil: FORREST SHREVE.

SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE, PACIFIC COAST BRANCH

This society held one session Wednesday afternoon, with the following program:

The effect of fine grinding upon starch: C. L. ALSBERG.

Study on the manner in which the toxin of Clostridium botulinium acts upon the body. III. Further investigations of the curves of fatigue in the muscles supplied by the voluntary nervous system: E. C. DICKSON and V. E. HALL.

The effect of stenosis upon the respiration during exercise: A. W. HEWLETT, J. K. LEWIS and ANNA FRANKLIN.

The effect of cooling on the excitability of nerve and muscle: E. G. MARTIN.

Further evidence of the rôle of the hepatic internal secretion in canine anaphylaxis: W. H. MANWARING.

A new insulin fraction which is active orally when given in water solution: W. D. SANSUM.

Diet and parathyroid tetany: T. INOUYE (Introduced by DR. GEO. R. COWGILL.)

Regulation of the hydrogen ion concentration and its relation to metabolism and respiration in the starfish: LAURENCE IRVING (introduced by E. G. MARTIN).

The carbonic acid-carbonate equilibrium in sea water, with special reference to respiration: LAURENCE IRVING (Introduced by E. G. MARTIN).

On Wednesday evening the society had an informal dinner at the Stanford Union.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

The ninety-fourth meeting of the society was held at Stanford University on June 25, 1924.

The morning session was called to order by President E. D. Van Dyke at 10:30 o'clock, in Room 430 of the Zoology-Entomology Building. There were 28 members and 12 non-members present. Six papers were presented as a symposium on the entomological activities on the Pacific Coast.

The afternoon session was called to order at 4 o'clock and 11 talks were given by visiting entomologists and members. Dr. L. O. Howard presented the greetings of the Entomological Society of Washington and Mr. W. M. Giffard the greetings of the officers and members of the Hawaiian Entomological Society.

AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS, PACIFIC COAST BRANCH

This society held formal sessions Thursday and Friday forenoon and afternoon, with papers as follows:

Some habits of the California lead cable borer: H. E. BURKE. (Illustrated.)

The garden centipede (Scutigerella immaculata Newp.): F. H. WYMORE. (Illustrated.)

Notes on an outbreak of cutworms: S. J. SNOW.

Cylindrocopturus jatrophae, a new economic pest: CHARLES T. VORHIES.

Forest insect control: H. E. BURKE.

Malaria: GEORGE E. STONE.

Arsenical residue and codling moth control: E. R. DE ONG.

Experiments on the efficacy of lead arsenate in protecting apples against codling moth injury: RALPH H. SMITH. (Illustrated.)

Studies of parasites of the alfalfa weevil in Europe: T. R. CHAMBERLIN.

The tule bill bug (Calandra discolor Man.). W. B. TURNER. (Read by C. M. PACKARD.)

The effect of weevily beans on the bean crop and upon the dissemination of the weevils, B. obtectus and B. quadrimaculatus: A. O. LARSON.

The possibilities of weevil development in neglected seeds in warehouses: C. K. FISHER.

Insects in cereal food products: R. W. DOANE.

The life history and biology of Echocerus cornuta: DAVID SHEPHERD.

The thurberia boll weevil and thurberia boll worm problem in Arizona: CHARLES T. VORHIES.

Lygus elisus on cotton in the Pacific region: E. A. MCGREGOR.

Calcium cyanide as a soil fumigant for wireworms: ROY E. CAMPBELL.

The citrophilus mealy bug as a pest of citrus: H. M. ARMITAGE.

Facts concerning fluctuation in numbers of beet leafhopper in a natural breeding area in the San Joaquin valley in California: H. H. SEVERIN.

Unique features of the program of this very active society were the first annual Pacific Coast championship ball game, played on the Faculty Club House Diamond, Friday afternoon, between the federal entomologists and the state entomologists. It is said the score stands 22 to 0 in favor of the state entomologists.

Following the conclusion of this arduous struggle the participants and their guests took part in an old-fashioned barbecue at the Faculty Club.

The meeting was probably the best the Pacific Coast branch has ever held, being notable both for the large attendance, which exceeded any previous meeting, and the number of distinguished entomologists present. Much benefit and pleasure were derived from the presence of these visiting members. Nineteen interesting and instructive papers were presented, together with two motion pictures on insect control. Newly elected officers are: *Chairman,* Leroy Childs; *vice-chairman,* Stanley Freeborn. The secretary is Roy E. Campbell.

SEISMOLOGICAL SOCIETY OF AMERICA

This society held one session Friday morning with the following program:

Origin of the earthquake forces in California: BAILEY WILLIS.

An absolute seismograph: PAUL KIRKPATRICK.

The torsion seismometer: J. A. ANDERSON and H. O. WOOD.

Some experiments with Milne-Shaw seismographs: E. A. HODGSON.

BOTANICAL SOCIETY OF AMERICA, PACIFIC DIVISION OF PLANT PHYSIOLOGICAL SECTION

Sessions were held on Friday forenoon and afternoon with the following program:

Gravity as a formative stimulus: G. J. PEIRCE.

Experiments in bud correlation: F. E. CLEMENTS.

A study of the conductive tissues in the stems of Bartlett pear, and the relationship of food movement to dominance of the apical buds: F. E. GARDNER.

Are cambial activity and food reserve correlated? E. L. PROEBSTING.

Root growth in the cotton in relation to the oxygen supply and to temperature: W. A. CANNON.

Physiological conditions in sphagnum bogs of the northwest coast: G. B. RIGG.

The molecular structure of the cell wall: O. L. SPONSLER.

Some remarks of the absorption of ions and the energy relations involved: D. R. HOAGLAND and A. R. DAVIS.

An apparatus for the growth of plants in a controlled environment: A. R. DAVIS and D. R. HOAGLAND.

The influence of potassium in the culture solution upon the formation of diastase by wheat: A. R. DAVIS and J. L. DOUGHTY.

The absorption of ions by plants in light and in darkness: A. R. DAVIS and O. E. NAY.

Combinations of single salt solutions as culture media for the growth of wheat: L. J. H. TEAKLE.

Observations on growth of plants with continual renewal of culture solutions: L. J. H. TEAKLE.

WESTERN SOCIETY OF NATURALISTS

The meetings were held at Stanford University on June 26 and 27. A symposium with the Ecological Society was held on Thursday morning; on Thursday afternoon there was a session for the reading of papers, and on Friday morning a joint meeting. In addition to the papers listed in the symposium on vegetation and the associated animal life in west-central California, in joint session with the Ecological Society of America, the following papers were presented:

The whales of the California coast: BARTON WARREN EVERMANN.

The Pan-Pacific Union food conservation congress to be held at Honolulu in August: BARTON WARREN EVERMANN.

Effect of gestation and lactation on activity and food consumption: J. R. SLONAKER.

Effect of compulsory work during gestation on mother and young: J. R. SLONAKER.

Motor deficiency effects in the guinea pig: A. W. MEYER.

Thyroxin as a depressor of cell division: H. B. TORREY.

Thyroxin as an accelerator of pigment: H. B. TORREY.

A remarkable development of the sporophyte in anthoceros: D. H. CAMPBELL.

Notes on life history of Ascarida perspicillum (Rud.): J. E. GUBERLET.

Mitosis in endamoeba dysenteriae: C. A. KOFOID AND OLIVE SWEZY.

Inheritance of reversal of geotropic response: E. B. BABCOCK.

The influence of pituitary gland removal on development of rana: B. M. ALLEN.

Ciliary currents in starfish: LAURENCE IRVING.

Multiple allelomorphs in the silkworm: ISABEL MCCRACKEN.

Exhibition of the hybrid Xiphophorus helleri × Platypœcilus rubra: ISABEL MCCRACKEN.

Progeny of species hybrids in crepis: MARGARET MANN.

On Friday evening, the Western Society of Naturalists and Ecological Society gave a dinner in the Stanford Union, and on Saturday the members of the two societies and their friends went on a field trip to La Honda, Moss Beach and other points of zoological, botanical and ecological interest in the Santa Cruz mountains and along the seashore.

The following officers were elected for the next year: *President,* Nathan Fasten, Oregon Agricultural College, Corvallis; *Vice-president,* H. M. Hall, Carnegie Institution of Washington, University of California, Berkeley; *Secretary-treasurer,* C. O. Esterly, Occidental College, Los Angeles, California; *Members of Executive Committee,* H. B. Torrey, University of Oregon, Eugene, and G. B. Rigg, University of Washington, Seattle.

While the Pacific Division of the American Phytopathological Society, the California Academy of Sciences, the Cooper Ornithological Club, the Lorquin Natural History Club, the Pacific Fisheries Society, the Sierra Club, the Utah Academy of Sciences and certain other affiliated societies did not hold separate sessions, their members contributed to the programs of various other societies.

OFFICERS OF THE PACIFIC DIVISION OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE FOR 1924–25

President—C. E. Grunsky, president of the California Academy of Sciences, and president of the American Society of Civil Engineers, 57 Post Street, San Francisco, California.

Vice-president and Chairman of the Executive Committee—Joel H. Hildebrand, professor of chemistry, University of California, Berkeley, California.

Members of the Executive Committee—Walter S. Adams, director, Mount Wilson Observatory, Pasadena, California (1928); Robert G. Aitken, associate director, Lick Observatory, Mount Hamilton, California (1927); Bernard Benfield, consulting engineer, Kohl Building, San Francisco, California (1929); William M. Dehn, professor of chemistry, University of Washington, Seattle, Washington (1925); Harvey M. Hall, Carnegie Institution of Washington, 1615 Loma Avenue, Berkeley, California (1926); Ernest G. Martin, professor of physiology, Stanford University, California (1929); Emmet G. Rixford, professor of surgery, Stanford University, 1795 California Street, San Francisco, California (1928).

The place and time of the 1925 meeting of the Pacific Division have not been determined further than that the meeting will be held either at Eugene or Portland, Oregon, sometime in June.

BARTON WARREN EVERMANN,
Acting Secretary